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ARIMETCO HEAP LEACH
AND
PROCESS COMPONENTS
WORK PLAN

AUGUST 23, 2002

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SECTION 1.0

INTRODUCTION

Atlantic Richfield Company has prepared this Draft Arimetco Heap Leach and Process Components Work Plan (Work Plan) to conduct field investigations that will support planning for permanent closure of five Heap Leach Pads (Heaps), their associated process components, and the process plant operated by Arimetco Inc. (Arimetco) within the Yerington Mine Site. Atlantic Richfield recognizes that these surface mine units are owned by Arimetco. As such, implementation of this Work Plan is contingent upon obtaining the legal approvals necessary to access Arimetco's property and conduct the proposed site investigation activities.

This Work Plan is being conducted pursuant to the Closure Scope of Work (SOW). As stated in the SOW (Brown and Caldwell, 2002), this Work Plan prescribes such characterization steps as the "performance of static and kinetic tests, analysis of whole rock geochemistry, and the collection of hydraulic parameters of pad materials". Process components such as ponds, conveyance ditches, tanks, the electrowinning facility, etc. will also be investigated. Results of the proposed site investigation activities presented in this Work Plan will be compiled and presented in a Data Summary Report.

The remainder of Section 1.0 of this Work Plan describes the location and hydrologic setting of the Heaps, previous sampling and analytical results, and the data quality objectives (DQOs) for this Work Plan in more detail. Section 2.0 presents information about the construction and operational history of the Heaps, and a description of their current status.

Section 3.0 presents the details of the site investigation activities including proposed sampling locations, sampling protocols, and quality assurance and quality control (QA/QC) objectives. Section 3.0 of this Work Plan also presents a task-specific Job Safety Analysis in the context of a more comprehensive Health and Safety Plan. Section 4.0 lists references cited in this Work Plan.

1.1 Location

The Yerington Mine Site is located west and northwest of the town of Yerington in Lyon County, Nevada (Figure 1). The Arimetco Heaps are located between the Yerington Pit on the south and agricultural private land on the north (Figure 2). The Heaps consist of five spatially distinct pads named by construction phase. Based on record drawings, engineering plans, and site testimony by Joe Sawyer of SRK Consulting (pers. comm., 2002), the four construction phases are briefly described below:

Phase I	Phase I is located immediately north of the Yerington Pit and southeast of the Arimetco Electrowinning Plant Site.
Phase II	Phase II is contiguous with Phase 1, and extends to the north and west of Phase I.
Phase III	Phase III consists of two separate lined Heaps north of the paved access road, northwest of the Arimetco Plant Site, and west of the Vat Leach tanks (Figure 2). The first Heap, built in three sub-phases, is located south of the second Heap, which is also known as the 4X Heap (the fourth phase of the Phase 3 Heap expansion)
Phase IV	Phase IV consists of two separate Heaps. The Slot Heap borders the eastern property boundary northeast of the Yerington Pit, and partially replaces a leached waste pile operated by Anaconda (Figure 2). The VLT Heap was also constructed to leach ore previously treated by Anaconda, and is located near the north end of the mine site, west of the evaporation ponds (Figure 2). The VLT Heap replaced a portion of the Oxide Tailings remaining from Anaconda's Vat Leach extraction process.

More detailed maps of the Heaps, and of the plant site, are provided in Figures 4 through 6.

1.2 Hydrogeologic Setting

The principal source of water in the Yerington area of Mason Valley is the Walker River (Huxel, 1969). The East and West Walker Rivers originate in the Sierra Nevada mountain range and merge south of the mine site, from where the Walker River flows northward through the valley to Walker Gap. From Walker Gap, it turns eastward and then southeastward to Weber Reservoir and ultimately to its terminus at Walker Lake. The Walker River is the primary source of natural recharge to the alluvial groundwater flow system that underlies the mine site, given that recharge from precipitation is very low (the annual average precipitation rate in the area is 5.46 inches per year; Huxel, 1969).

The native ground beneath the Heaps consists of unconsolidated alluvial deposits derived by erosion of the uplifted mountain block of the Singatse Range and alluvial materials deposited by the Walker River. These unconsolidated deposits, collectively called the valley-fill deposits by Huxel (1969), comprise four geologic units: younger alluvium (including the lacustrine deposits of Lake Lahontan), younger fan deposits, older alluvium and older fan deposits. Lake Lahontan lacustrine deposits appear to have been removed and reworked by the Walker River as it meandered back and forth across the valley (Huxel 1969). Huxel estimated that Pleistocene Lake Lahontan in Mason Valley persisted for a relatively short time and was less than 60 feet deep.

The Heaps were constructed with impermeable liners in accordance with the Nevada Administrative Code (NAC), and the ancillary process components were also lined to contain all process fluids. The Heaps and associated ponds were designed to withstand a 24-hour/100-year recurrence storm event and contain the 24-hour/10-year recurrence storm event.

The ponds and ditches associated with the Heaps have exhibited leakage through primary liners into leak detection systems with the potential for leakage from secondary liners. Additionally there have been anecdotal observations (Joe Sawyer, pers. comm., 2002) of mixed solution/stormwater runoff overflow during storm events. Though monitoring does not suggest that these occurrences affected groundwater hydrology, degradation of groundwater quality from solution losses may have occurred during Heap operations.

A detailed assessment of groundwater conditions at the Yerington Mine Site is the subject of a Groundwater Conditions Work Plan, a companion of this Arimetco Heap Leach Work Plan. The assessment of groundwater flow and quality beneath and down-gradient of the mine site, including the Heaps, will be discussed in the companion Work Plan.

1.3 Previous Monitoring and Data Acquisition

Existing information for the Arimetco Heaps primarily consists of documentation regarding the construction and operation of the Phase III and IV pads. For earlier Phases, records are incomplete. Recent exploratory testing by the U.S. Environmental Protection Agency (EPA, 2000) and the results of water quality monitoring conducted by Arimetco prior to abandoning the site are available. Consultants retained by the Nevada Division of Environmental Protection – Bureau of Corrective Actions (NDEP) to manage process fluids on site are the most reliable sources of information related to current Heap management (e.g. Mr. Joe Sawyer of SRK Consultants). The remainder of Section 1.3 introduces existing information sources and discusses their significance to the site investigation activities proposed in this Work Plan.

Construction Testing and QA/QC

Construction monitoring and materials testing results for the Phase II Heap C and D extensions, and Phase III and IV Heaps are available. In addition, engineering design reports for the Phase III and IV Heaps contain significant operational history information. Design drawings and as-built drawings exist for the Phase I, II, III, and IV Heaps although there is limited construction information for the Phase I Heap. Construction design, monitoring and Quality Control results are summarized in Table 1.

Heap Material Geochemistry

EPA conducted geochemical analyses on samples of Heap leach material from the Phase I/II contiguous Heap, Phase III (southern Heap), and Phase IV Slot and VLT Heaps. Whole-rock analyses were performed on these samples as part of an initial CERCLA evaluation of the site. This data is presented in Table 2, along with background soils data from Shacklette and Boerngen (1984) and Rose et. al (1979). In general, as seen in Table 2, the analytical results from EPA's soil testing program indicate that surface Heap leach materials are suitable for long-term surface exposure, given the background values for the area.

During engineering design of the Phase IV (Slot and VLT) Heaps, samples of the proposed leach materials were tested under the NDEP's Meteoric Water Mobility Procedure (MWMP), and subjected to static testing (i.e., acid/base accounting). The results of these tests are included herein as Appendix B. The acid-base accounting (ABA) results indicate that these materials are slightly acid consuming (net acid neutralization potential, 0 > NNP < 10).

Additionally, the fine-grained sulfide tailings produced by Anaconda's recovery process were tested under the MWMP for use as secondary liner materials for the Heaps. Although the extent of its use is not well documented, its compacted permeability was found to be on the order of $1x10^{-7}$ to $1x10^{-8}$ cm/s. The pH of the effluent from this test was higher than that of the lixiviant, suggesting (though not quantifying) that the materials possess acid neutralizing minerals.

Heap Drain-down Solution Quality

Prior to abandoning the mining operations at the site, Arimetco analyzed Heap drain-down quality under Water Pollution Control Permit (WPCP) NEV88039. The most recent Quarterly Report obtained in review of historical documentation is from the third quarter of 1999, provided as Appendix A. Water quality analytical results from monitoring wells MW-1, MW-5, and WW-10 and from a number of Heap solution sampling locations are provided in this report. Sampling locations included Phase III 4X, VLT PLS pond, Slot PLS pond, Plant Feed (representative of combined effluent from all Arimetco Heaps), and the Raffinate Pond (representative of mineral-depleted Heap leach solution from all Heaps). The solution was used to extract metals from the ore placed on the Heaps, resulting in high metals concentrations.

The Quarterly Report also contains weekly records of leak detection system inspection for all process components operated under the WPCP. These components include the: VLT Pad, Slot Pad, Phase I Pad, Phase II Pad, FX Phase III Pad, Megapond, Plant Area, and PLS and secondary ponds throughout the fluid management system.

Physical Stability

Arimetco's 1993 Phase IV assessment and engineering report includes an evaluation of Heap slope stability, recommended constructed slope angles and benches, and soil strength properties. Because the Heap materials are essentially identical in geologic character and grain size distribution for the Phase I/II, III, and IV-Slot Heaps, precious geotechnical results may be generalized in a physical stability evaluation for all of these Heaps. The Phase IV-VLT Heap material is essentially a 0.5-inch-minus aggregate base material. The strength and compaction properties of the VLT materials and run-of-mine Heap materials should yield similar physical stability results for mine unit closure. Therefore, no further geotechnical information for these materials will be required. Field data such as in-place angle of slope repose may also be used in such an evaluation.

1.4 Data Quality Objectives

The Data Quality Objectives (DQOs) for field sampling and analytical activities described in this Work Plan include the collection of appropriate data to support the:

- Assessment of ecological and human health risk from exposed Heap leach materials to possible down-wind and down-gradient receptors, and identification of such receptors;
- Assessment of ecological and human health risk resulting from historical seepage of Heap leach solution to groundwater below the Yerington Mine; and
- Development of closure alternatives for the Arimetco Heaps and associated process units at the Yerington Mine Site.

A four-step DQO process was utilized to develop the activities described in this Work Plan. The DQOs will ensure that data of sufficient quality and quantity are collected to meet the project objectives. The four steps include:

- Step 1. State the Problem;
- Step 2. Identify the Decision;
- Step 3. Identify the Inputs to the Decision; and
- Step 4. Define the Boundaries of the Study.

The problem statement (Step 1) is as follows: "Heap materials and effluent have the potential to create a risk to human health and the environment, and to potentially degrade groundwater beneath the Yerington Mine Site".

Step 2 of the DQO process (Identify the Decision) asks the key question that this Work Plan is attempting to address: "What monitoring, sampling and analytical activities for the Arimetco Heaps will serve to evaluate the potential for ecological and human health risk, potential degradation of groundwater, and support closure of the Yerington Mine site?" The field monitoring and sample collection and analysis activities proposed in this Work Plan will be integrated with previous investigations and analytical results to answer this question. The criteria necessary to determine if the proposed Work Plan activities will answer this question include:

- Will the collected data adequately document the potential source characteristics and potential migration pathways of solids and liquids associated with the Arimetco Heaps;
- Will the collected data support an evaluation of environmental pathway processes that could affect the fate and transport of these materials; and
- Will the collected data provide an appropriate baseline to evaluate closure alternatives for the Heaps (e.g. solution containment, reduction, and/or treatment; chemical and physical stability of leached solids).

Step 3 of the DQO process (Identify the Inputs to the Decision) identifies the kind of information that is needed to address the questions posed under Step 2. Relevant historical information includes knowledge of Heap Leach Pad construction, operations and maintenance, previous field monitoring and analytical results. The information obtained from the proposed site investigation activities will provide an adequate basis to address the other criteria of the DQO Process.

Step 4 of the DQO process (Define the Boundaries of the Study) defines the spatial and temporal aspects of the field monitoring, sampling and analytical activities proposed in this Work Plan. The field and analytical activities described in this Work Plan are anticipated to be conducted for the five identified Heaps and associated process components shown on Figure 2 from 2002 through mid 2003.

The DQO steps described above will be consistent with the Conceptual Site Model (CSM), currently under review by the Yerington Technical Work Group (YTWG). The flow diagram for the CSM is reproduced as Figure 3 of this Work Plan. The Arimetco Heaps are identified as potential sources within the "surface mine units and process areas" category in Figure 3.

SECTION 2.0
BACKGROUND INFORMATION

The Arimetco Heaps shown in Figure 2 were constructed between 1989 and 1999 for the purpose of extracting copper from both newly mined ore from the MacArthur pit located approximately 3 miles north of the Yerington Mine Site, and from waste rock, tailings, and ore previously processed by Anaconda Mining Company from 1953 to 1978. The Anaconda leaching processes were less efficient than modern extraction methods, and sufficient copper values remained in the "spent" ore and in materials previously defined as waste rock to justify re-processing. Arimetco commingled pregnant solution from the various Heaps in the Plant Feed Pond west of the Arimetco Plant Site, and after solution extraction by electro-winning (SX/EW), this solution was treated with sulfuric acid in the Raffinate ponds and then pumped to the various Heaps for re-leaching.

The remainder of Section 2.0 includes a discussion of each Heap and the Plant Site organized under the following headings:

- Construction
- Land Status
- Physical Description
- Piping and Ancillary Features
- Operation
- Leak Monitoring

Phase I and II Heaps are contiguous, and have been grouped together for this Work Plan. The Phase III and III-4X Heaps contain similar materials and are adjacent to one and other. For these reasons, these two Heaps are also grouped together. The Phase IV-Slot and VLT Heaps are geographically and materially distinct, and are discussed separately.

2.1 Phase I/II Heaps

Construction

Arimetco personnel constructed the Phase I/II Heaps, and limited records exist for their construction and operation (a summary of their construction and monitoring information is presented in Table 1). Phase I was likely constructed between 1989 and 1990 to leach low-grade sulfide ore stockpiled by Anaconda, as well as newly mined material from the MacArthur Pit. It consists of a single 40-ml High-Density Polyethylene (HDPE) liner over compacted alluvium and fill materials. A solution ditch surrounding the Phase I area drains to a low point in the northeast corner of the pad, immediately north of a land bridge built between the Phase IV-Slot and Phase I/II Heap Leaches (Figure 4 and Photo 1).

The Phase I Heap originally covered an approximately 6-acre lined area and was built to approximately 100 feet in height. The Phase II Heap expanded west and north from the Phase I pad, eventually covering an additional 8-acre lined area. A variable 2- to 10-foot thick “blanket” of VLT material was placed on the liner surface to act as drain rock, and to protect the liner from the more irregular and angular run-of-mine material to be leached.

Land Status

The Phase I/II Heaps are located entirely on private land (Figure 2).

Physical Description

The contiguous Phase I/II Heap currently occupies a lined area of approximately 14 acres. The minimum elevation is about 4470 feet above mean sea level (amsl) at the north end, near the PLS pond. A “sump” exists at approximately 4472 feet in elevation on the west side of the Heap. This feature was probably a sediment control basin for the original Phase I Heap, but now collects the minor drain-down from the south end of both the Phase I and II Heaps (an east-west lined berm exists near the middle of the contiguous Heap). The maximum elevation is approximately 4590 feet, and a generally flat surface of approximately 3 acres exists at the top of the Heap.

The Heap material consists of run-of-mine low-grade sulfide ore, possibly both mined from the MacArthur Pit and relocated from low-grade sulfide ore and/or waste rock from earlier Anaconda operations. The ore material is a low-mica quartz monzonite with some sulfide alteration on joint faces. Other replacement minerals (e.g., chlorite) and trace metal sulfides are also present. The material appears to be poorly graded, from 6-inch plus to silt-sized particles.

Piping and Ancillary Features

A lined berm and solution ditch exists around the entire perimeter of the Phase I/II contiguous Heap (Figure 4). The ditch is lined with at least one layer of HDPE. Solution drain-down reports to either a lined sump to the west, or the PLS pond to the north. Drain-down to the sump is pumped intermittently to the PLS pond (see Appendix D, Photo 5). Currently, the PLS pond is generally dry, and all fluids draining to it have evaporated in place. Because of the generally dry condition, the PLS pond has limited potential to leak or overflow. Two raffinate ponds exist northwest of the Phase I/II contiguous Heap (Figure 4). These ponds have historically exhibited significant leakage, and are maintained in a dry condition except for incidental run-on and meteoric water collection.

Piping related to the Phase I/II Heap Leach include a line from the west sump to the PLS pond, drain pipes from the Phase II ditch to the PLS pond, and unused leach pipes on the surface and slopes of the Heap (Figure 4). Leach piping may also exist within the Heap. Recent draining of unused pipes reporting to the PLS pond have resulted in temporary standing water.

Operation

Initial leaching of the Phase I/II Heap ended in 1996, but was re-started in early 1997 for approximately five months, with a leaching rate of 400 to 500 gpm. All drain-down not evaporated from the PLS pond was transferred to other Heaps from 1997 until the present (drain-down flow rates are presently too low to accumulate in the PLS pond). Current drain-down is on the order of 1 gpm or less, and has completely ceased during some summer months. (Joe Sawyer, pers. comm., 2002)

Leak Monitoring

Eleven leak detection points exist around the Phase I/II Heap, and in the vicinity of the Arimetco Plant Site (Figure 4). All detected leaks were contained by the secondary liner, and were pumped back up to the Heap.

2.2 Phase III Heap

Construction

Arimetco personnel constructed both Phase III Heaps, shown in Figure 4. A hydrologic and geotechnical site characterization report was prepared by Arimetco (1990), and concluded that the alluvium on which the southern Phase III Heap was built was "…ideal as a sub-base for construction of all necessary facilities." The southern portion of the Phase III Heap was constructed between 1990 and 1992 to leach low-grade sulfide ore, as well as newly mined material from the MacArthur Pit. The northern Phase III-4X Heap Leach was constructed between 1992 and 1995 for the same purpose.

Both Heaps include a secondary liner of compacted, naturally occurring clayey material. Single 40-mil HDPE liners were constructed for solution recovery. The solution drainage ditch also includes a polynet leak detection system over a second 40-mil HDPE membrane. The solution ditch surrounding the southerly Phase III Heap drains to a collection pond in the southeast corner of the pad (see Appendix D, Photo 4) and to the Megapond (see Appendix D, Photo 5), a large linear lined pond located to the east. Solution from the Phase III-4X Heap solution ditch drains to a low point near the southeast corner of the pad (Figure 4).

The Phase III Heap covers approximately 46 acres and the Phase III-4X Heap covers approximately 50 acres. A variable 2-foot to 10-foot thick "blanket" of VLT material was placed on the liner surface to act as drain rock and to protect the liner from the more irregular and angular run-of-mine material to be leached.

This is a draft report and is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon, please consult the final report.

Land Status

The southern portion of the Phase III Heap is primarily located on private land, and approximately 6 acres of the eastern portion of the pad is located on public land controlled by the BLM (Figure 2). The Phase III-4X Heap Leach is evenly divided between private and public land, with the public land constituting the central and southwestern portions of the pad. Solution ditches and containment berms are located on public land. Associated pipes, containment features, and ponds for both Heaps are located entirely on private land.

Physical Description

The Phase III Heap covers approximately 46 acres. The minimum elevation is about 4492 feet amsl at the Megapond. The collection basin to the southeast is shallow and has a base elevation of about 4528 feet amsl. The maximum elevation is approximately 4660 feet amsl along a berm generally along the west top edge of the Heap. A generally flat surface of approximately 15 acres exists at the top of the Heap in two benches (Figure 4).

The Phase III-4X Heap covers approximately 50 acres. The minimum elevation is about 4498 feet amsl at a point in the southeastern corner of the pad, from which solution formerly drained to the Megapond. The maximum elevation is approximately 4654 feet amsl. A generally flat surface of approximately 22 acres exists at the top of the Heap in three benches (Figure 4).

The Heap material consists of run-of-mine low-grade sulfide ore, possibly both mined from the MacArthur Pit, and relocated from low-grade sulfide ore and/or waste rock from earlier Anaconda mining. The leached ore surface is visually identical to that in the Phase I/II Heap. The material appears poorly graded, from 12-inch plus to silt-sized particles (see Appendix D, Photo 7).

Piping and Ancillary Features

A lined berm and solution ditch exists around the entire perimeter of both Phase III Heaps. The ditches are double HDPE-lined with leak detection polymesh geotextile between the membranes.

Drain-down from the Phase III Heap reports either to the plant feed pond, from which it may also be re-directed to the VLT by pumping into the 16-inch gravity line or to the Megapond, from which it is pumped by a barge pump into the 16-inch gravity drain line to the VLT solution ditch. It may also report to a depressed sump in the Anaconda Plant Site area (Figure 4 and Appendix D, Photo 6). Solution collected in this sump is intermittently pumped back into the Megapond. Other pipes related to the Phase III Heaps exist, including unused pressure pipes from the Megapond leak sump and unused leach pipes on the surface and slopes of the Heap. Leach piping may also exist within the Heap.

Drain-down from the Phase III-4X Heap reports to the southeast corner of the pad, and is collected by a screened 4-inch pipe (Figure 4 and Appendix D, Photo 9). This pipe drains by gravity alongside the 16-inch gravity line, and reports to the southern corner of the VLT solution ditch.

The collection ponds and drainage ditches, have folds and leach material "dams" that allow standing water to collect. Where standing water occurs, it is generally concentrated by evaporation resulting in the occurrence of sulfate evaporite minerals. EPA sampled this evaporite occurrence, and the laboratory analytical results are included in Appendix C.

Operation

Leaching of the Phase III Heap ended in early 1997, and re-started for several months in early 1998 at 400 to 500 gpm on the southern portion of the Heap. Current drain-down to both ponds is on the order of four gpm or less. Leaching of the Phase III-4X Heap ended in 1999. Solution drain-down rates have decreased from 1,620 gpm during operations to approximately 3 gpm at the current time.

Leak Monitoring

Nine leak detection points related to the Phase III Heaps exist, as shown in Figure4. All detected leaks were contained by the secondary liner, and were pumped back up to the Heap.

2.3 Phase IV Slot Heap

Construction

Construction of the Phase IV Slot Heap is well documented in the Arimetco (1993) Site Assessment, which includes information not available for the previously constructed Heaps. The Slot Heap was initially constructed on a starter pad that had previously been excavated into the W-3 waste rock dump and asphalt-lined area. This waste rock pile is discussed in detail in the companion Waste Rock Work Plan.

The Slot Heap, shown in Figure 4, was expanded to the north by excavating further into the W-3 waste and transporting this material the short distance to the Slot Heap between 1993 and 1996. The pad includes a primary liner of 40-mil HDPE and a secondary liner of compacted naturally occurring gray lean clay. The solution drainage ditch also includes a polynet leak detection system over a second 40-mil HDPE membrane. The solution ditch surrounding the Slot Heap drains to the eastern side, and is routed to one of two PLS ponds either directly or through a sediment control basin.

The Slot Heap covers approximately 86 acres of the total proposed area of 115 acres (Figure 4). A variable 2-foot to 10-foot thick “blanket” of VLT material was placed on the liner surface to act as drain rock and to protect the liner from the more irregular and angular run-of-mine material to be leached. Independent contractors retained by Arimetco constructed the pad liners, solution ditches and ponds. The Slot Heap was constructed in 20-foot lifts by Arimetco personnel. A summary of construction and monitoring information is presented in Table 1.

Land Status

The majority of the Phase IV-Slot Heap is constructed on public land, with a portion of the west and south slopes on private land. Most pipes, containment features, and ponds for the Slot Heap are located on public land (Figure 2). Some solution ditches and containment berms are located on private land.

Physical Description

The Slot Heap covers approximately 86 acres. The minimum elevation is about 4400 feet amsl at the outlet to the sediment control basin and PLS ponds. The maximum elevation is approximately 4545 feet amsl along several berms on the east side of the Heap top surface. A generally flat surface of approximately 37 acres exists at the top of the Heap in five benches (Figure 4). The overall slope of the Slot Heap was designed at 2.4H:1V and the average slope, as measured from the two-foot topographic base, appears to be consistent with this design slope.

The Heap material consists of run-of-mine low-grade sulfide ore mined from the W-3 Waste Rock Area. The leach material rock is a quartz monzonite with little or no sulfide alteration on joint faces. The material appears poorly graded from 12-inch plus blast rock to silt-sized particles.

Piping and Ancillary Features

A lined berm and solution ditch exists around the entire perimeter of the Slot Heap (Figure 4). The ditch is double HDPE-lined with leak detection polymesh geotextile between the membranes. Drain-down from the Heap reports to one of two PLS ponds on the east of the pad, from which it was pumped to the surface of the Heap for evaporation via a system of mechanical evaporators ("wobbler" and modified wobbler misters; see Appendix D, Photo 12). Various pipes related to the Slot Heap include unused pressure pipes from both PLS ponds, the recently decommissioned evaporation system, leak detection pipes, and unused leach pipes on the surface and slopes of the Heap. Leach piping may also exist within the Heap.

Given recent declining drainage rates, this system has been modified, and solution is currently pumped via an 8-inch HDPE pipeline to the Plant Feed Pond west of the Arimetco Plant Site. Because the northern PLS pond has historically leaked, solution is primarily routed to the southern PLS pond, and the northern pond is pumped dry when necessary (see Appendix D, Photo 11). Crystal growths of evaporite minerals exist in both ponds and the solution drainage ditches. The EPA sampled this evaporite, and the results of laboratory analysis are included in Appendix C.

Operation

Arimetco ceased adding make-up water and acid to the Heap in November 1998, and solution was transferred to the VLT Heap fluid management system in 2000. Solution drain-down has decreased from 2,200 gpm during normal operation to the current rate of approximately 34 gpm.

Leak Monitoring

The seven leak detection monitoring points for the Slot Heap are shown in Figure 4. All detected leaks were contained by the secondary liner, and were pumped back up to the Heap.

2.4 Phase IV VLT Heap

Construction

The VLT Heap covers approximately 54 acres, as shown in Figure 5. The VLT Heap was constructed on the southern portion of the previously operated Finger Evaporation Ponds and alluvium north of the existing VLT Tailings Area. The VLT Heap was extended to the south by excavating into the VLT tailings, and transporting this material to the Heap. The construction period was between 1995 and 1998. The leach pad includes a primary liner of 40-mil HDPE and a secondary liner of compacted naturally occurring gray lean clay. The solution drainage ditch also includes a polynet leak detection system over a second 40-mil HDPE membrane. The solution ditch surrounding the VLT Heap drains to the northeast corner, and is routed through a large sediment control basin to a single PLS pond (see Appendix D, Photo 13). It may also cover portions of the “Finger” evaporation ponds.

Independent contractors constructed the pad liners, solution ditches and ponds, and the Heap itself was constructed in 20-foot lifts by Arimetco personnel. A stormwater run-on diversion ditch for the 100-year, 24-hour design storm event of 2.6 inches was designed to convey a peak flow rate of 650 cfs, and was to direct run-on to several lined evaporation ponds to the north of the VLT Heap. However, it is not clear from site topography and ground inspection that this diversion was built. A summary of VLT Heap Leach construction and monitoring information is presented in Table 1.

Land Status

The entire VLT Heap and its solution ditches, ponds, and other ancillary features are constructed on private land (Figure 2).

Physical Description

The VLT Heap covers approximately 54 acres. The minimum elevation is about 4386 feet amsl at the outlet to the sediment control basin. The maximum elevation is approximately 4514 feet along several berms on the east side of the Heap top surface. A generally flat surface of approximately 29 acres exists at the top of the Heap in two benches (Figure 5). The overall slope of the Heap was designed and constructed at 2.4H:1V.

The Heap material consists of crushed oxide ore previously leached in a vat process. The rock is a quartz monzonite with no surface mineralization readily apparent. Other replacement minerals (e.g., chlorite) and trace metal sulfides are also present, as indicated by leach solution and MWMP chemistry. The EPA sampled evaporite minerals similar to those found in other Heaps, and the results of laboratory analysis are included in Appendix C. Observation and reviewed documents indicate that the material is a very homogeneous poorly graded 0.5-inch-minus to sand sized crusher product. Sulfide ore from an unidentified source is present on several Heap slope faces, and may have been placed to protect the finer VLT materials from wind and/or water erosion.

Piping and Ancillary Facilities

A lined berm and solution ditch exists around the entire perimeter of the Heap (Figure 5). The ditch is double HDPE-lined with leak detection polymesh geotextile between the membranes. Drain-down (see Appendix D, Photo 14) from the Heap reports to a PLS pond at the northeast corner of the pad, from which it is pumped to evaporators on an approximate 3-acre, 1200-foot by 100-foot bench on the southeastern face of the VLT Heap. Various pipes including the active pressure pipe from the PLS pond, piping for the evaporation system, leak detection pipes, and unused leach pipes on the surface and slopes of the Heap (Figure 5). Leach piping may also exist within the Heap.

Solution is delivered to one or more high-efficiency "snowmaker" type evaporators (see Appendix D, Photo 15), which are run from site power or, in the event of power loss have been run from portable generators. Because there is approximately 5.04 million gallons (design) capacity in the single VLT PLS pond, the current cumulative flow from all site Heaps of approximately 76 gpm indicates a storage capacity of approximately 46 days. However, stormwater runoff from the VLT Heap and other facilities, and potential stormwater run-on from the upgradient alluvial fan could decrease this safety margin.

Operation

Arimetco ceased adding make-up water and acid to the VLT Heap in November 1998. Solution drain-down has decreased from 3,300 gpm during operation to the current rate of approximately 35 gpm. The mechanical evaporators currently operate on a daily cycle, as needed.

Leak Monitoring

The five leak detection points for the VLT Heap are shown in Figure 5. All detected leaks were contained by the secondary liner, and were pumped back up to the Heap.

2.5 Arimetco Electrowinning Plant Site

Construction

Arimetco constructed its mineral recovery circuit after acquiring the Yerington Mine in 1989, in conjunction with the Phase I Heap Leach. Limited records and historical description are available for the extraction facility and its components.

Land Status

The entire Electrowinning Plant Site is located on private land (Figure 2).

Physical Description

The Plant Site (Figure 6) consists of a Solution Extraction/Electro-Winning (SX/EW) building on the north side (see Appendix D, Photos 16-17), a multiple-stage concrete Raffinate Storage Tank, offices, laboratory (see Appendix D, Photo 18) and a maintenance shop. Two HDPE-lined Raffinate Ponds are located east of these structures.

Piping and Ancillary Facilities

A large number of buried and exposed pipes, valves, monitoring ports, and pumps (all currently unused) exist at the Arimetco Plant Site. Additionally, areas between the buildings are currently filled with refuse. The interior of the SX/EW building, lab, and shop buildings may contain a significant amount of abandoned equipment, chemicals in containers, and other items. An existing inventory of such items is provided as Appendix E.

Operation

Arimetco continued processing solution through the Plant Site until its abandonment of the mine site in January 2000.

Leak Monitoring

Leak monitoring points for the two HDPE-lined Raffinate ponds are shown on Figure 6. All detected leakes were contained by the secondary liner, and were pumped back into the ponds.

2.6 Summary of Current Conditions

After filing for bankruptcy in 1998, Arimetco abandoned its operations at the Yerington Mine in January 2000. The leach pads and associated process components contained approximately 90 million gallons of pregnant leach solution. NDEP responded to this situation by assigning resources from the Environmental Response and Mitigation (EMAR) program to conduct fluid management activities at the site in order to prevent a release of Heap solutions. The EMAR subcontractor, SRK Consulting, retained several former Arimetco employees (including Mr. Joe Sawyer as Site Manager) to manage the

Heap solutions and maintain the process components at the site. Fluid management and site maintenance currently involves the following activities:

- Several pumps are operated intermittently to direct drain-down effluent or leakage from primary containment to the VLT system for evaporation. Additionally, 3 to 5 “snowmaker” type evaporators are operated on the VLT Heap on a daily schedule to reduce solution inventory. Each pump is inspected or turned on and off during each daily shift.
- In addition to active pumping, solution drains by gravity flow from the Phase III-4X solution ditch, and a variety of pipes for existing or historical purposes exist and are visually inspected for leakage or failure.
- Solution drainage rates are measured by several weirs on the mine site, including the Slot, Phase III-4X, and VLT solution ditches. Leak detection systems are monitored, and records of leakage are maintained on-site.
- Site personnel conduct a variety of activities that enhance environmental and safety conditions including the drainage of standing pipes to existing ponds, relocation of transformers and other potentially hazardous features to covered areas, general cleanup, and site security.
- Plans to remove all process solutions from the Plant Site are being discussed by NDEP and EPA.

SECTION 3.0
WORK PLAN

Atlantic Richfield proposes to conduct site investigations of the Arimetco Heap Leach Pads, related process components and the Plant Site pursuant to the SOW, including: "static and kinetic tests, analysis of whole rock geochemistry, and the collection of hydraulic parameters of pad materials". Given that these facilities are lined, they should not have significant potential to degrade waters of the State. Process components associated with the leach pads (e.g., ponds, ditches, etc.) and the Plant Site (e.g., raffinate ponds and the electro-winning building) will also be investigated. Soils associated with these process areas, and other areas of reported spills, will also be characterized. All site investigations, and related quality assurance/quality control (QA/QC) procedures, will be consistent with the DQOs described in Section 1.4.

As described in Section 2.0, drain-down rates from all the Heaps have declined greatly since operation ceased. The observation that drain-down from the Phase I/II Heaps have declined to less than one gpm, with zero drain-down during summer months, indicates that the current fluid management system is working well to reduce the inventory of solution in the Heaps. Given these empirical data, this Work Plan includes continued monitoring of drain-down rates and effluent water quality as the best method to evaluate the water balance, drain-down predictions, and solution chemistry for each Heap.

This Work Plan provides for the evaluation of the following general characteristics of each Heap, and its associated process components:

- Material Volume
- Material Geotechnical and Geochemical Characteristics
- Solution Volumes, Drain-down Rates and Chemistry
- Process Component Inventory

The geochemistry of Heap materials will be an important factor in the evaluation of closure options because of the potential for leachate to degrade waters of the State or create an ecological or human health risk. Additionally, the agricultural properties of the soil (phytotoxicity of certain metals, availability of nutrients needed by revegetation or volunteer vegetation, and physical parameters such as grain size, gradation and water retention) will determine whether it can be used directly as a growth medium, or will require mixing with other materials or covering. The geochemical characteristics of sludge in process ponds and soils in process areas will also require evaluation.

In order to demonstrate physical stability of the Heaps, relative to final post-closure conditions, material characteristics will have to be evaluated to support slope stability and stormwater management concerns. Erosion-resistant materials may be required in the post-closure stormwater management design. The physical characteristics of process area components such as the electro-winning plant, building foundations and pond liners will also be evaluated from a closure perspective.

Prior to the start of work, field personnel will conduct a health and safety meeting to review the Site Health and Safety Plan and to verify personal training certification. Copies of training certificates and attendance logs from the meeting will be obtained. All work will be conducted in accordance with the Site Health and Safety Plan, and with the JSA provided in Section 3.4.

3.1 Heap Characterization

Characterization of the Heaps, associated process components and Plant Site includes specific tasks for the proposed site investigations:

<u>Material Volumes</u>

The quantity of material contained in each of the Heaps will be calculated by interpolating adjacent grades to estimate original ground topography, and comparing this surface with a Digital Terrain Model (DTM) based on topography generated by photogrammetric methods and dated August, 2001.

Material Geotechnical and Geochemical Characteristics

Given the general homogeneous nature of the materials observed on the Heaps (e.g., the VLT Heap materials are very uniform), Atlantic Richfield anticipates that the proposed sampling locations shown in Figures 4 and 5 will be the final number of samples collected for geotechnical and geochemical characterization of the Heaps. However, during sample collection, a detailed visual inspection of Heap materials exposed on the surface will be performed to determine whether additional samples should be collected to address the occurrence of significant mineralogical or weathering variations observed on the surface of the Heaps. Rationale for additional sampling, if performed, will be documented, as described below.

The potential for Heap materials to generate fugitive dust, and the capacity of the material to retain moisture will be evaluated. Samples will be collected for laboratory analysis of grain size distribution (ASTM D-422 testing method). The grain size distribution data will be used to estimate the field capacity, wilting point, and saturated hydraulic conductivity of the Heap materials. This information may be used to evaluate the moisture storage capacity as a component of surface hydrology analyses, and in characterization of the Heap materials for use as a growth medium.

The samples collected from the Heaps will also be used for whole-rock analysis. These samples will be submitted to a Nevada-certified laboratory for the parameters listed in Table 5. In addition, the samples will be used for agricultural analysis and acid-base accounting (ABA).

Solution Volumes, Drain-down Rates and Chemistry

The Phase I/II Heap Leach has been observed to dry completely during dry summer periods, and therefore solution currently draining is probably limited to infiltrated meteoric water. Based on the final solution application date of approximately August 1997, the simplification may be made that this Heap completely drained over a four-year period. Heap leach pads in Nevada have been observed to drain at an exponential or geometric rate (i.e., a decaying rate of decline that asymptotically approaches zero). Therefore, Atlantic Richfield proposes to evaluate the ongoing monitoring by NDEP of solution drain-down rates to establish empirical drain-down curves for each Heap. These curves will be used to:

- Estimate the volume of solution that remains in inventory within the Heap; and
- Predict the future drainage characteristics of each Heap after mine site closure.

These drain-down curves will be illustrated graphically within the Data Summary Report for the Arimetco Heaps. The data will also be compared to an equivalent saturated pore volume based on the estimated porosity of materials within each Heap.

Samples of drain-down solution will be collected in 2002 from each Heap to evaluate the current chemical characteristics of the solutions. These samples will be submitted to a Nevada-certified laboratory for a modified Profile II analysis for constituents listed in Table 6. Sampling and analytical protocols are described in Section 3.3.

<u>Process Component Inventory</u>

The fluid management components including ponds, pipelines, pumps, leak detection ports, and other features associated with each Heap will be catalogued by observation and interview of EMAR personnel on site. Pipe size, length and size and number of pumps will be recorded on a standard Catalog Form, provided in Appendix F. The inventoried process components will be integrated into the closure evaluation for each Arimetco Heap and for the Arimetco Electrowinning Plant Site.

3.2 Plant Site Characterization

The extent and number of hazardous materials spills, and the potential of concrete and other storage or processing materials to leach or otherwise release contaminants into the environment will determine the level of effort required to close the Arimetco Plant Site. The Raffinate Ponds may serve to illustrate the effects of leakage from all solution ponds operated by Arimetco, and the depth and significance of contamination from process fluid release may affect closure planning. If significant quantities of stored chemicals exist within the Plant Site, these occurrences may influence to closure activities.

Plant Site Inventory

A Plant Site inspection will be conducted in the company of EMAR personnel to supplement the existing inventory prepared for NDEP (Appendix E). The inventory will identify all features, materials and areas of potential or reported spills with significance to closure of the Arimetco Plant Site. The site will be mapped using large-scale aerial photographs and other detailed topographic base maps to identify buildings, solution management features, extent of disposed material or equipment, and the size of buildings or other features. The physical condition of each component, and extent of unused materials or disposed waste will be noted. Equipment and fixtures located within the buildings will be catalogued, with particular attention to valves, sumps, containers, or tanks which may contain chemicals or process solution.

Field Screening

The proposed field screening and potential sampling locations of representative soils in the Arimetco Electrowinning Plant Site area are shown in Figure 6, and listed in Table 3. Field screening will be conducted using calibrated pH meter and Photo Ionization Detection (PID) instrument to collect field data on soils collected with a backhoe, hand auger or shovel at depths up to 12 inches below ground surface. The screening event will identify exposed and sub-surface soils with concentrations of organic vapors (i.e., potential petroleum impact) that exceed 20 parts per million by volume (ppm-v) and/or with paste pH values less than 5.5. If, at any location, organic vapor is detected above 20 ppm-v and/or paste pH values are less than 5.5 standard units, a composite soil sample will be collected for laboratory analyses at that location from the 6- to 12-inch interval below ground surface (bgs).

Up to half of the proposed field screening locations that pass the field screening pH criteria (i.e., paste pH values greater than 5.5 s.u.) will be selected for ABA and whole-rock analyses to ensure a representative characterization of soils for an assessment of human health and ecological risk.

For pH field screening, a solution will be created in the field with soils and de-ionized water, and pH readings will be performed with a calibrated field pH meter. Five grams of soil will be collected from a field screening location and weighed into a four-ounce glass jar, on an electronic digital scale, to the nearest 0.1-gram. A five-milliliter aliquot of de-ionized water will be measured in a graduated cylinder, and added to the five grams of soil. The jar will be sealed with a teflon-lined lid, and shaken vigorously. After 30 minutes of allowing the jar to sit undisturbed, the jar will be shaken again. The lid will be removed and the pH instrument probe inserted into the soil/water solution. After the pH instrument readout stabilizes, the pH measurement will be recorded in a field notebook. At one of ten sample locations, the prepared soil/water solution will be checked with pH litmus paper (0 to 14 pH units) to provide reasonable quality assurance of the instrument readouts.

For organic vapor measurements, portions of each field screening sample will be placed in a sealed plastic bag and allowed to sit in direct sunlight to generate vapor. Organic vapor readings will then be performed with a portable organic vapor monitor (OVM) equipped with a PID by inserting the OVM inlet into the plastic bag and recording the maximum vapor reading in parts per million by volume (ppm-v).

Based on the field screening, composite samples collected for laboratory analysis for soils impacted by acidic solutions or petroleum hydrocarbons would be subjected to the following procedures:

- Total petroleum hydrocarbons (extractable TPH-E) for locations with organic vapor concentrations that exceed 20 ppm-v.
- Laboratory pH and acid-base accounting (ABA) for locations with paste pH values less than 5.5.
- Whole-rock geochemistry for selected locations with paste pH values less than 5.5.

Field screening results would be used to determine whether any additional excavation and sampling activities were necessary to delineate the vertical or lateral extent of impacted soils at a particular location. If soil paste pH values are measured at less than 5.5 and/or organic vapors are detected to be greater than 20 ppm-v at three feet bgs, an additional composite sample would be collected and stored. This procedure would continue at depths of six feet, ten feet, and every five-foot depth after ten feet bgs until field screening criteria are met (i.e., pH greater than 5.5 and organic vapors less than 20 ppm-v).

A confirmatory composite soil sample would then be collected at the appropriate depth from the soil (alluvial) depth determined to be unaffected by acidic solutions or hydrocarbons. The initial and confirmatory soil samples would then be submitted for one or more of the laboratory analyses listed above.

Agricultural parameter testing will be conducted for representative composite soil samples throughout the Arimetco Electrowinning Plant area.

Sample Collection and Handling

Soil samples will be collected from each excavation by sampling from the backhoe bucket, or from the hand auger or shovel. Sample collection depth will be limited by excavation equipment capabilities, or until ground water is encountered. The composite samples will be placed in containers appropriate for each analysis. All soil samples to be analyzed for TPH will be immediately labeled and placed into iced coolers for transport under chain-of-custody to a Nevada-certified analytical laboratory. Soil data, sample collection intervals, and field screening measurements will be recorded on the appropriate excavation log during the investigation. Soil data will include soil color, moisture content, consistency, and a visual estimate of Unified Soil Classification.

If groundwater is encountered during backhoe excavations, the excavation will immediately end. No groundwater samples from the excavation would be collected because of the potential for groundwater to become contaminated from the excavation activities. Digging through the subsurface exposes ground water to soil that is being pushed or has fallen down from above the water table, compromising the actual water quality. If required, the need for groundwater monitoring in the Arimetco Electrowinning Plant Site area will be evaluated in the Groundwater Conditions Work Plan.

Decontamination

All soil collection (sampling) equipment shall be decontaminated between each excavation. Disposable scoops or plastic trowels will be used, or sampling equipment shall be decontaminated between each sampling location. Sampling equipment will be hand-washed with a solution of tap water and Alconox detergent, then double-rinsed. The decontamination wash would be accomplished with clean buckets, filled half to three-quarters full as follows:

- Bucket 1: Tap water with non-phosphate detergent such as Alconox
- Bucket 2: Clean tap water or de-ionized water.
- Bucket 3: Clean tap water or de-ionized water.

Equipment decontamination consists of the following general steps:

- Removal of gross (visible) contamination by brushing or scraping.
- Removal of residual contamination by scrub-washing in Bucket #1, rinsing in Bucket #2, then rinsing in Bucket #3. Change the water periodically to minimize the amount of residue carried over into the third rinse.

All washing and rinsing solutions are considered investigation derived waste and will be placed in containers. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Sample Identification and Preservation

Sample labels shall be completed with a permanent waterproof marker and attached to each laboratory sample container before each sample is collected, and shall include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed

- Sample substance type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number will consist of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, the sample collected during the third sampling event at the fourth location sampled will be labeled: 003WD004. Blanks and duplicate samples shall be labeled in the same fashion, with no indication of their contents. For example, the duplicate sample to the one stated above might be labeled: 003WD006.

<u>Sample Handling and Transport</u>

The QA objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging, and shipping are not introducing variables into the sampling chain that could render the validity of the samples questionable. In order to fulfill these QA objectives, blank and duplicate QC samples will be used as described below. If the analysis of any QC samples indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QC sample will be evaluated for the possibility of contamination.

Duplicate samples will be collected at a frequency of one in ten samples for each matrix and analysis. Duplicate samples will be collected by filling the sample containers for each analysis at the same time the original soil sample is collected. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent “blind” to the lab. For quality assurance purpose, no special labeling indication of the duplicate shall be provided.

Each collected sample container shall be labeled, sealed with a custody seal, sealed in a zip-loc© bag, logged on a chain-of-custody form, and placed in a cooler with ice. Contained ice shall be double bagged in zip-loc plastic bags. Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. If ice chest is being sent by mail: (a) enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid; (b) Label ice chest with “Fragile” and “This End Up” labels. Transport ice chests to the appropriate laboratory by hand-delivery as soon as possible or via express overnight delivery. Coordinate deliveries with the laboratory, ensuring that holding times are not violated.

Each chain-of-custody shall contain the following information:

- Project name
- Sampler’s name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Method of shipment

For soil or sediment samples collected for ABA or whole-rock analysis, each sample will be collected in zip-loc bags or a five-gallon bucket (see Section 3.5) that will be sealed and labeled with similar QA/QC procedures described for other soil sample labeling and packaging prior to shipment to the analytical laboratory.

3.3 Data Collection and Analysis Procedures

Procedures for data collection and analysis will follow the specifications and standard operating procedures (SOPs) described in this section. These procedures will adhere to QA/QC methods to ensure that the quality and quantity of the analytical data obtained during the field activities are sufficient to support the DQOs. QA/QC issues include:

- Detection limit and laboratory analytical level requirements;
- Selection of appropriate levels of precision, accuracy, representiveness, completeness, and comparability for the data and any specific sample handling issues; and
- Identification of confidence levels for the collected data.

Field Measurements

Measurements in the field will consist of flow rates and field parameters of Heap solutions in pipes or Heap leach drainage channels. Flow from pipes will be obtained by filling a container of known volume and recording the time required to fill the container. Flow in drainage channels will be performed by measurement of depth in an installed weir, where available. Flow based on transfer volume from leak detection sumps will be evaluated based on NDEP fluid management records for the most recent fluid transfer event.

Field parameters for solutions will include pH, temperature, electrical conductivity, dissolved oxygen, and color. Field information will be recorded in a field notebook. For each sampling event, the information described in the documentation section, provided below, will be recorded. Prior to sampling, the pH, dissolved oxygen and electrical conductivity probe(s) will be calibrated and the conductivity probe will be checked with a standard. After sampling is completed, a drift check will be performed with each instrument, using the same standard solutions used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different locations. If solution measurements are obtained at a non-specific geographic location (e.g. the weir at the entrance to the settling pond for the VLT Heap Leach) the monitoring and sampling location will be established using a portable GPS receiver.

Solids Sampling

Field parameters, including distinguishing rock appearance, paste pH, and temperature will be recorded in a field notebook prior to obtaining solids samples. Heap and soil materials will be sampled by removing, with hand tools (e.g., disposable plastic trowels or shovels), the “evaporite-mineral crust” layer and excavating from a single sample location approximately 2.5 gallons of material. This material will the shaken in a 5-gallon bucket to eliminate strata variation effects, and the following splits will be obtained by hand-sorting to eliminate oversized material:

- For whole rock analysis, obtain a 2 kg (approximately 1 quart sample) in a clean re-sealable baggy.
- For Agricultural and ABA analyses, obtain a minimum of two (2) 1 kg (approximately 1 pint samples) in clean re-sealable baggies.

Where grain-size analysis samples are indicated, the 5-gallon bucket will be re-filled from the same location. No attempt to screen over-sized material will be made.

Solution Sampling

Heap drain-down samples at each location will be collected prior to recording field parameters or measuring flow. High-density polyethylene (HDPE) bottles, supplied the analytical laboratory, will be used to collect samples. Prior to collecting the actual lab sample, the collection bottle will be marked with a collection sequence number. Latex gloves will be used to handle bottles and equipment throughout each sampling event. The gloves will be changed between each sample location.

Total metals (unfiltered) samples will be each collected in 500-milliliter (mL) bottles. The following is a brief summary checklist for water sampling, based on the sampling protocol outlined above:

1. Locate accessible drainage ditches or pipe discharges where access and sampling activities create minimal disturbance to the solution being sampled. Proposed sample locations with stagnant drain-down solution will not be sampled.
2. Wear a new pair of latex gloves prior to each sampling location. Place indelible identifying mark or label on the container. Fill container directly by carefully submerging a portion of the mouth of the container into the flow, with the body of the container and hand downstream of bottle mouth. Adjust the container position as needed to obtain a nearly full container (a small head-space may remain).
3. Thoroughly rinse container, dumping out downstream of where sample will be collected. Repeat two more times.

4. Measure and record flow (if possible), pH, conductivity, and temperature.
5. Preserve all samples as appropriate, compete documentation, package and ship or transport samples.

Surface Materials Evaluation

Samples specified for whole rock analysis will be evaluated by a Nevada-certified laboratory for the geochemistry of the digested rock and soil material. The constituents and detection limits for these analyses are listed in Table 2.

Samples specified for agricultural parameters evaluation will be submitted to a laboratory experienced in the evaluation of soils for use as a growth medium. The samples will be tested for the following parameters:

- Nitrogen, Phosphorus, and Potassium (NPK)
- Boron and Chlorine
- Calcium, Magnesium and Sodium
- Sodium Absorption Ratio (SAR)

Solution Evaluation

Samples of drain-down solutions will be analyzed for the amended Nevada Profile II constituents shown in Table 6 by a Nevada-certified laboratory.

Sample Identification and Preservation

Sample labels will be completed and attached to each laboratory sample container after each sample is collected. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time

- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consisted of two parts:

- Sampling location
- Collection sequence number

For example, the sample collected on the Phase III-4X Heap Leach at the fourth location sampled will be labeled: HL3-4X004. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their contents. For example, the duplicate sample to the one stated above might be labeled: HL3-4X010.

The following sample preservation methods will be followed for solution water samples. Add nitric acid to a pH less than 2 after sample collection. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

<u>Sample Handling and Transport</u>

The QA objectives for the sample-handling portion of the field activities are to verify that packaging and shipping are not introducing variables into the sampling chain that could provide any basis to question the validity of the analytical results. In order to fulfill these QA objectives, blank and duplicate QC samples will be used as described below. If the analysis of any QC samples indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QC sample will be evaluated for the possibility of contamination.

The following sample packaging and shipment procedures will be followed for the Heap solution samples to ensure that samples are intact when they arrive at the designated laboratory:

1. Place a custody seal over each container, and place each container in double zip-loc plastic bags and seal the plastic bags shut.
2. Place the protected containers in the appropriate ice chest.
3. If required, fill empty spaces in the ice chest with either pelaspan (styrofoam popcorn) or bubble-pack wrap to minimize movement of the samples during shipment. Contained ice will be double bagged in the same manner as samples.
4. Enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid.
5. Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.
6. Label ice chest with "Fragile" and "This End Up" labels. Include a label on each cooler with the laboratory address and the return address.
7. Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery.

Duplicate samples will be collected at a frequency of one in ten samples. Duplicate samples will be collected by filling the bottles for each analysis at the same time the original sample is collected. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent "blind" to the lab. For quality assurance purpose, no special labeling indication of the duplicate will be provided.

A blank sample will be collected by pouring the blank water directly into the sample bottles at one of the sample locations. De-ionized water will be used for collecting blank water samples. For quality assurance purpose, field blanks will be labeled in the same manner as other samples and will be sent "blind" to the lab, with no special indication of the nature of the sample.

Collected samples of Heap drain-down solutions will be labeled, logged on a chain-of-custody form, sealed in re-sealable bags, and placed in a cooler with ice. Cooler ice will be contained in double re-sealable bags to avoid leakage during shipment or transport. All samples will be kept secure in the custody of the sampler until they are transferred to the laboratory. Chain-of-custody protocol will be followed throughout the transport process. Each chain-of-custody will contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Number and volume of sample containers
- Analyses requested
- Filtration completed or required
- Method of shipment

For soils or Heap materials, each sample will be collected in either a 5-gallon bucket or a 1-quart re-sealable bag, that will be sealed and labeled with similar QA/QC procedures described for the water sample labeling and packaging prior to shipment to the analytical laboratory.

3.4 Site Job Safety Analysis

A site-specific Job Safety Analysis (JSA) for this Work Plan is attached as Appendix G, in accordance with Atlantic Richfield Health and Safety protocol and the Brown and Caldwell Yerington Mine Site Health and Safety Plan (SHSP). The SHSP identifies, evaluates, and prescribes control measures for safety and health hazards, in addition to providing for emergency response at the Yerington Mine site. SHSP implementation and compliance will be the responsibility of Brown and Caldwell, with Atlantic Richfield taking an oversight and compliance assurance role. Any changes or updates will be the responsibility of Brian Bass with Brown and Caldwell, with review by Atlantic Richfield Safety Representative Lorri Birkenbuel. Three copies of this plan will be maintained. One copy will be located at the site, one copy will be located in Atlantic Richfield's Anaconda office, and one copy will be located in the Brown and Caldwell office. The SHSP includes:

- Safety and health risk or hazard analysis;

- Employee training records;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);
- Decontamination procedures;
- Emergency response; and
- Spill containment program.

The SHSP includes a section for site characterization and analysis that will identify specific site hazards and aid in determining appropriate control procedures. Required information for site characterization and analysis includes:

- Description of the response activity or job tasks to be performed;
- Duration of the planned employee activity;
- Site accessibility by air and roads;
- Site-specific safety and health hazards;
- Hazardous substance dispersion pathways; and
- Emergency response capabilities.

All contractors will receive applicable training, as outlined in 29CFR 1910.120(e) and as stated in the SHSP. Copies of Training Certificates for all site personnel will be attached to the SHSP. Personnel will initially review the JSA forms at a pre-entry briefing. Site-specific training will be covered at the briefing, with an initial site tour and review of site conditions and hazards. Records of pre-entry briefings will be attached to the SHSP.

Elements to be covered in site-specific briefing include: persons responsible for site-safety, site-specific safety and health hazards, use of PPE, work practices, engineering controls, major tasks, decontamination procedures and emergency response. Other required training, depending on the particular activity or level or involvement, may include MSHA 40-hour training and annual 8-hour refresher courses. Other training may include, but is not limited to, competent personnel training for excavations and confined space, first aid, and cardio-pulmonary resuscitation (CPR). Copies of the MSHA certificates for site personnel will be attached to the SHSP.

The individual JSA for the Arimetco Heap Leach work incorporates individual tasks, the potential hazards or concerns associated with each task, and the proper clothing, equipment, and work approach for each task. The following table outlines the tasks and associated potential hazards that are included in the Arimetco Heap Leach JSA:

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS
1. Prepare sample containers and dress in appropriate PPE.	• Burn or corrosion from acid spillage, if sample bottles do not have acid already in them.
2. Collect solution samples and decontamination of equipment.	• Skin irritation from dermal or eye contact • Slipping or falling into ponds, drainage ditches, or along embankments.
3. Collect solid materials samples	• Skin irritation from dermal or eye contact • Skin exposure to and/or inhalation of solution evaporator mist on or near VLT Heap Leach • Steep slopes, hard, sharp, irregular surfaces on all Heap Leaches
4. All Activities	• Slips, Trips, and Falls
5. All Activities	• Back, hand, or foot injuries during manual handling of materials.
6. All Activities	• Heat exhaustion or stroke.
7. All Activities	• Hypothermia or frostbite
8. Unsafe conditions.	• All potential hazards.

A copy of the Arimetco Heap Leach JSA is provided in Appendix G.

SECTION 4.0

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